Are All Free Choice Minerals The Same?

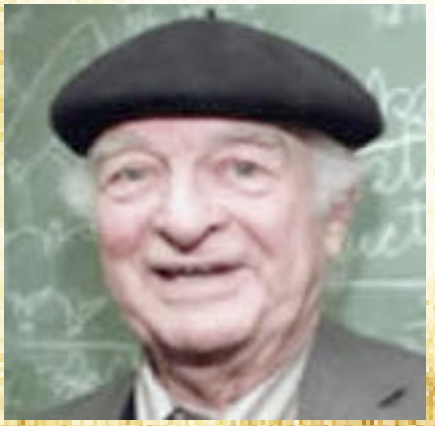
Advanced Biological Concepts® Mission Statement:

“Improve the quality of life for mankind; by improving the quality of life for animals through nutrition.”

Guidelines for Achieving Our Mission Statement:

1. **We always focus on the cause of a disease/problem, not the symptom.**
2. **We refrain from Research and Development involved in symptom relief.**
3. **We believe most poor health problems in animals are due to a nutritional deficiency caused by the confinement of animals, thereby, limiting their access to a variety of nutritional ingredients.**
4. **We do not prescribe the use of poison or mega doses of single nutrients to enhance production.**
5. **Often improvement in health can be dramatic when furnishing a balanced diet or adding nutrients that are lacking in the animal's diet. Not unlike giving food to a starving animal, this creates a dramatic improvement in health. This mode of nutritionally assisting animals must not be confused with drug therapy or medicine. We do not prescribe replacing the body's own mode of action through supplementation with synthetic chemicals and artificial components. We supply the body with what it needs to repair itself.**

“You can trace every disease and every infection to a mineral deficiency from unequally yoked energy fields.”



Linus Pauling

1901 – 1994

The only person to ever win

two unshared Nobel prizes.

Consider this:

All domestic animals today suffer from 3 main problems that affect mineral balance.

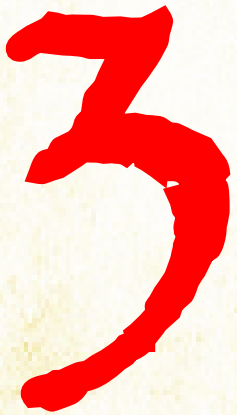
1 Soil Depletion

… results in lower nutritional value of crops.

2

Varying degrees of confinement

… allows less nutritional diversity.



College Educated Feed Company Nutritionists

… who recommend excess protein and force fed minerals.

Many mainstream nutritionists tend to dispute the ability of an animal to balance its nutritional needs. They also consider it normal for animals to eat dirt, chew on wood, and drink or lick urine.

These are all signs of a mineral imbalance and can be eliminated by providing individual free choice minerals.

What Makes a Good Mineral Program?

A Good Mineral -

- Has the proper balance of Ca:P and the phosphorus is bio-available.
- Meets the mineral (major and trace) requirements of all the animals in the group without excesses or deficiencies.
- Automatically adjusts for the different soil types and soil mineral balance in the various regions of the country.
- Automatically adjusts for the variation of individual mineral requirements.
- Resolves any negative effects of unbalanced ratios between the various trace minerals.
- Contains DUA™ (prebiotics, probiotics & enzymes) that enable your animals to efficiently digest fiber in the ration, thus release the minerals and other nutritional ingredients already present in your feed for greater cost savings. DUA™ eliminates the need for consumption limiters.
- Does NOT contain consumption limiters to lower mineral cost at the expense of the animals' health.
- Contains a proprietary blend that addresses the effects that glyphosate contamination has on the safety and quality of feedstuffs.

How does your mineral compare?

	ABC	Brand X
Ca:P balanced & P bio-available (Mono-Sodium Phosphate)	Yes	?
Meets Major & Trace Mineral needs	Yes	?
Auto-adjustment for regional soil types	Yes	?
Auto-adjustment for individual needs	Yes	?
Meets Grass Fed Beef criteria	Yes	?
Meets Organic criteria	Yes	?
Adjusts mineral ratio interrelationships	Yes	?
Prebiotics, Probiotics & Enzymes	Yes	?
Addresses Glyphosate Contamination	Yes	?
NO consumption limiters or enhancers	Yes	?

Limiters

and

Enhancers

Does Your Mineral contain consumption limiters or enhancers?

The addition of limiters or enhancers is the same as feeding a one-bag-fits-all mineral; it interferes with the animal's nutritional wisdom to choose what it needs.

The answer to high levels of any mineral or vitamin consumption should be met with re-evaluation of the nutritional inputs …NOT the addition of limiters.

Limiters **are added to some minerals to limit consumption of the more expensive items. This is false economy as it does not allow the animals to take what they need to maintain health and sets the timer for future herd health and production problems.**

Commonly used limiters:

- **Salt**
- **Sodium Bicarbonate**
- **Sodium Carbonate**
- **Cinnamaldehyde**

At certain levels, salt is a superior carrier for some trace minerals (e.g. Cu & Zn). Salt can also be a limiter if the ratio is incorrect. Salt is used as a limiter in combinations with Sodium Bicarbonate and Sodium Carbonate.

NOTE: Free choice non-iodized, non-mineralized white feeding salt must be given in addition to all free choice mineral systems.

Enhancers **are added to some minerals to force consumption of some items so that they conform with University Standards of mineral consumption.**

This practice forces the animals to consume an unbalanced mineral diet and also sets the timer for future health problems.

Common enhancers:

- **Soy products**
- **Other high calorie sources**
- **Flavoring agents**

Applied Common Sense

The Role of Prebiotics, Probiotics and Enzymes

Prebiotics Probiotics Enzymes

Increase fiber digestion, the source of major and trace minerals in a natural chelated form.

Why buy minerals when your feed stuffs (hay, grass and grain) can supply them.

Increase protein conversion.

There is less need to purchase off-the-farm protein sources.

D.U.A.™

A broad spectrum, comprehensive prebiotic, probiotic & enzyme.

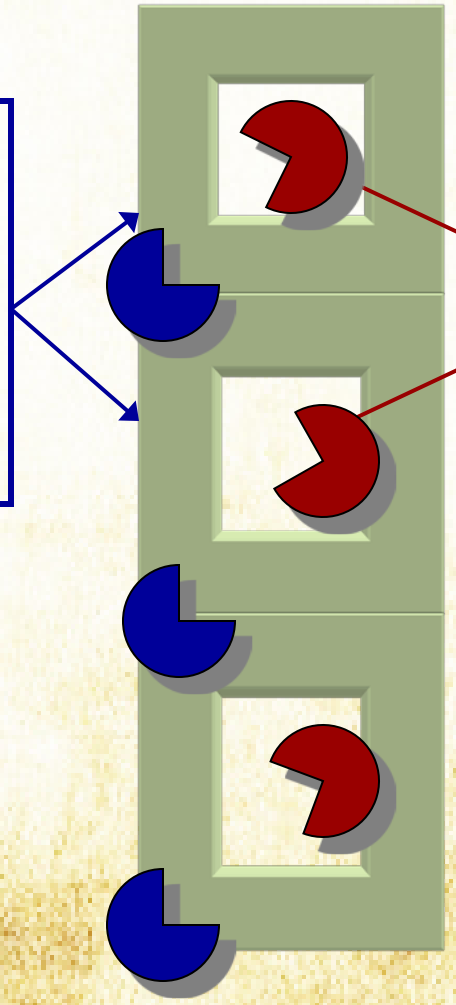
included in

12 Stones Grassland Beef®
Free Choice System
&
Advanced Biological Concepts®
Organic Free Choice System

Fiber Digestion

Cell Wall

- Minerals
- Sugars (Carbon)
- Protein



Cell Contents

- Amino Acids
- Sugars
- Starch

DUA™

PREBIOTICS

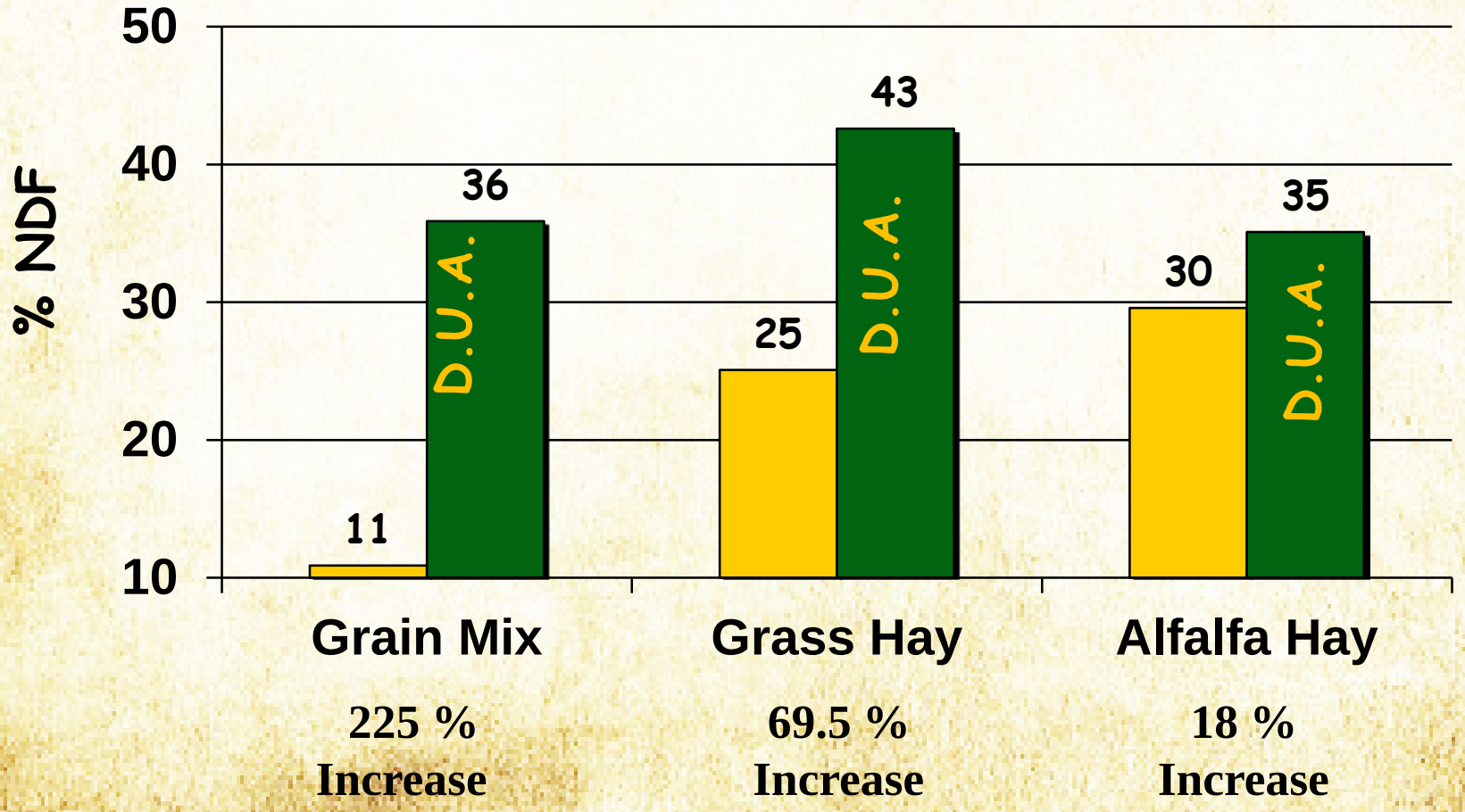
at work

DUA™

ENZYMES

at work

Effect of Feeding D.U.A.™ on Fiber Digestion



Don’t Forget Water!

Water stands alone as the most important nutrient.

For every 1 lb. of dry matter, 3 lbs. of water should be consumed.

The over consumption of minerals can often be traced to imbalanced minerals in the water and/or water with low conductivity.

Some free choice systems only pay attention to the calcium:phosphorus ratio, assuming all livestock are identical in their requirements of vitamins & minerals.

The majority of Universities teach that all animals are identical and have the same nutritional requirements. Producers know that concept is false.

The same philosophy is used in the justification of free choicing a complete mineral, that all animals, pastures & feedstuffs are identical.

A Different Perspective

Many of us pay close attention to the effect soils have on animal health but few consider the effect that animals have on soil health.

The use of individual free choice minerals allow the animals to balance the soil.

Natural Mineral Cycle

Soil

Soil & Grass
become more balanced

Grass

Natural occurring salt and mineral licks allow animals to fine-tune their mineral balance.

Deer, buffalo, elk, and other wildlife lick minerals and carry it out to other areas, improving the soil balance.

Manure

Deposited back on the soil after having been acted upon by rumen bacteria, enzymes, pre & probiotics

Force Fed Minerals Cycle

Soil
Imbalanced

Soil
Becomes more Imbalanced

Grass
minerals not in balance

Animal
forced to eat an imbalanced mineral

Manure
Contains the excess residue of un-utilized force fed minerals

If you force feed inappropriate vitamin/mineral mixes, animals attempt to balance their mineral needs by eating dirt, chewing wood, or eating dead rabbits.

Individual Mineral Cycle

Soil
Poorly balanced

Soil & Grass
Become more balanced

Grass
Poorly balanced

Animal
Consumes only what it needs

Manure
Only contains the excess residue of minerals chosen by the animal to meet deficiencies.

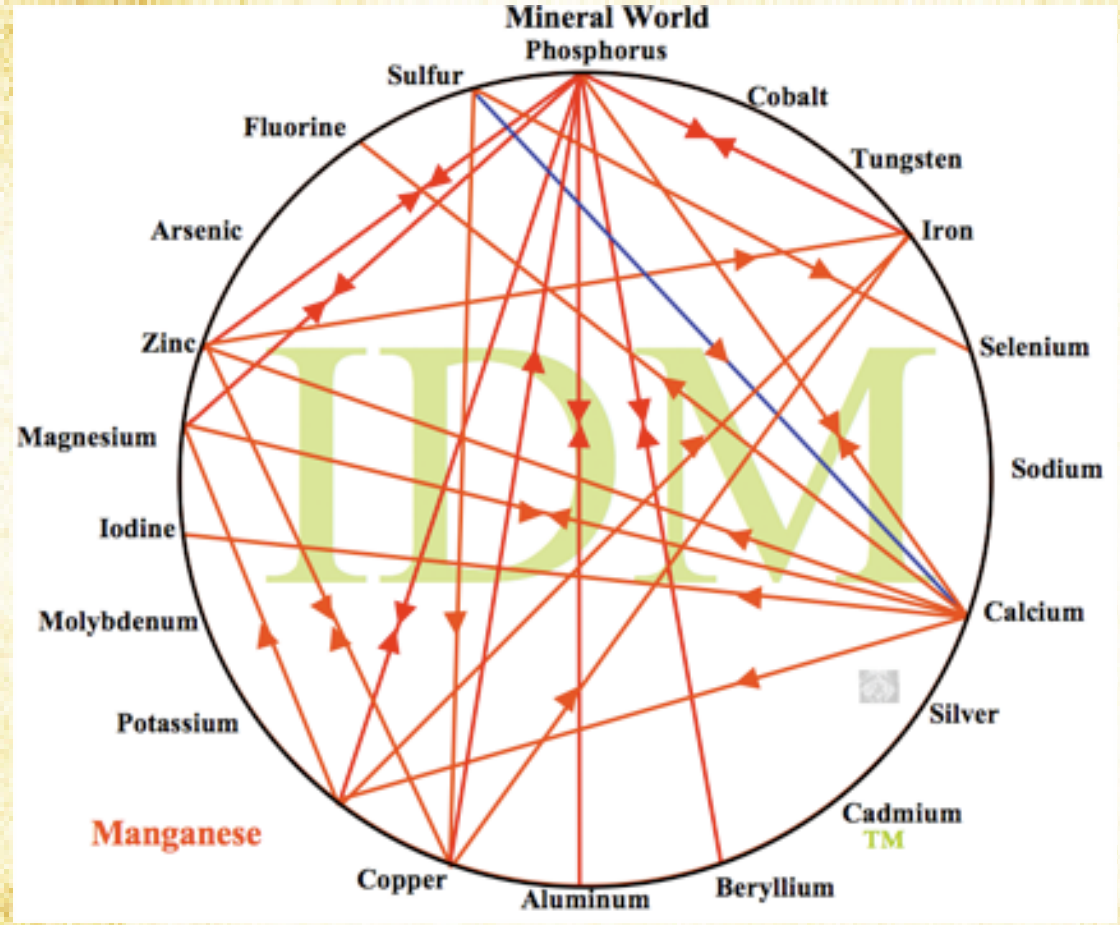
Self selected minerals allow animals to fine-tune their mineral balance.

Mineral Feeder replaces old time mineral lick.

“Mineral deficiency affects animal performance shortly after mineral deprivation, but it may take several months before showing clinical signs.

By cutting minerals in a cow’s diet it is actually setting a timer for production and reproduction failure.”

G.R.P.™

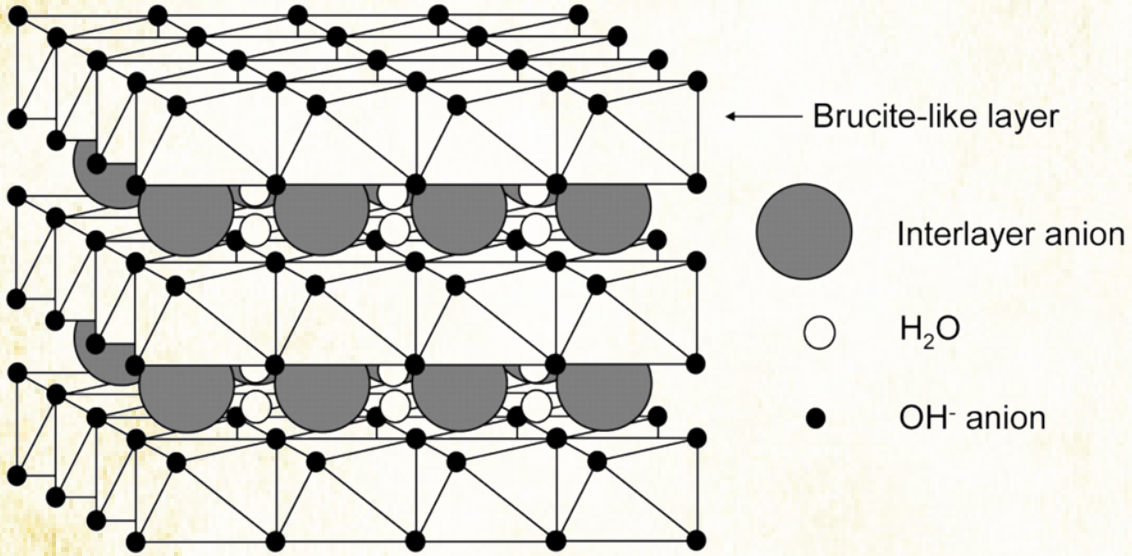


Glyphosate particularly reduces the availability of Manganese - an element necessary for the function of Calcium and Phosphorus.

Calcium and Phosphorus, available and in proper balance, are essential to the utilization of the majority of the other elements in the Mineral World as illustrated in the chart shown above.

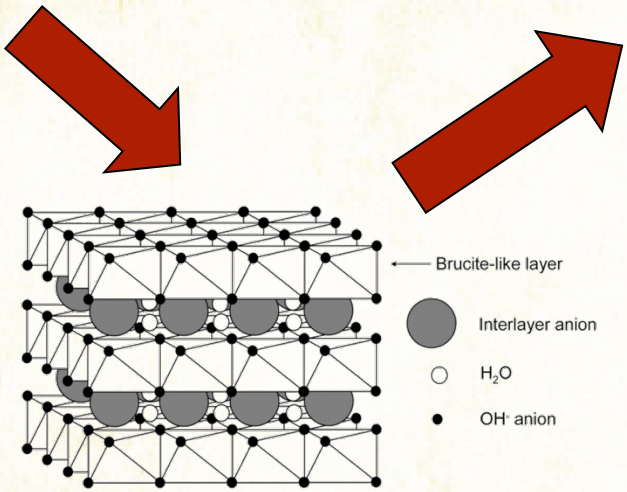
Glyphosate affects the availability of Manganese, Calcium and Phosphorus; thus almost all the other elements as well. The actual mechanism is much more complex!

Glyphosate Matrix

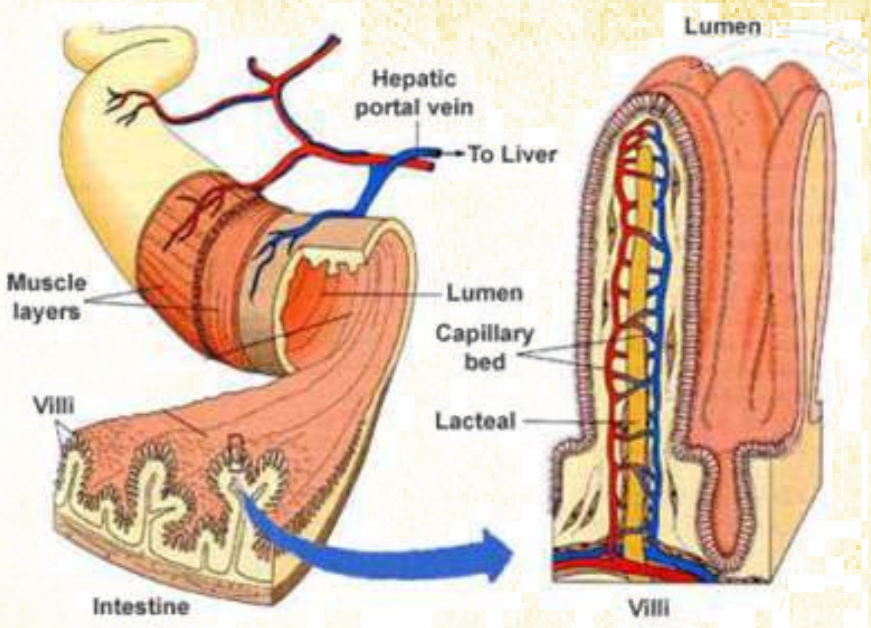


The inter-layer anion captures the cation mineral, rendering it useless.

Glyphosate ties up: **Manganese (Mn), Potassium (K), Selenium (Se) Magnesium (Mg), Calcium (Ca), Nitrogen (N), Copper (Cu), Nickel (Ni), Iron (Fe), Cobalt (Co) Zinc (Zn)**



Glyphosate Matrix



When a glyphosate contaminated plant is digested, the glyphosate matrix present in the plant is released into the gut and ties-up the supplemental minerals in the ration.

Advanced Biological Concepts®

has researched & developed a new process to chelate minerals resistant to glyphosate residuals.

D.U.A. G.R.P.™

Advanced Biological Concepts® Applied Common Sense.

USDA ORGANIC

Dietary Nutritional Supplement for Dairy Cattle, Beef Cattle, Sheep, Goats, Swine, Poultry, and Llamas

GUARANTEED ANALYSIS

Crude Protein	(min)----------9.5 %	Phosphorus (P)	(min)----------1.0 %
Lysine	(min)----------0.05 %	Sodium (Na)	(min)----------0.5 %
Methionine	(min)----------0.05 %	Sodium (Na)	(max)----------1.0 %
Crude Fat	(min)----------3.5 %	Copper (Cu)	(min)----------600 PPM
Crude Fiber	(max)----------7.5 %	Copper (Cu)	(max)----------800 PPM
Acid Detergent Fiber (ADF)	(max)--------27.0 %	Zinc (Zn)	(min)--------1,500 PPM
Calcium (Ca)	(min)----------4.0 %	Vitamin A	(min)---180,000 IU/LB
Calcium (Ca)	(max)----------5.0 %		

INGREDIENT STATEMENT

This product contains only certified organic agricultural products or ingredients that conform to the NOP's national list of materials acceptable for organic livestock production.™

INGREDIENTS:

Dried Lactobacillus Acidophilus Fermentation Product, Organic Oat Groats, Reed-Sedge Peat, Diatomaceous Earth, Dicalcium Phosphate, Calcium Carbonate, Attapulgite Clay, Organic Alfalfa Meal, Monosodium Phosphate, Organic Soybean Oil, Organic Rice Bran, Organic Dried Kelp, Bentonite, Salt, Choline Chloride, Organic Linseed Meal, Magnesium Oxide, Yeast Culture, Ferrous Sulfate, Sodium Sulfate, Potassium Chloride, Zinc Sulfate, Manganous Oxide, Ascorbic Acid, Vitamin E Supplement, Citric Acid, Manganese Sulfate, Organic Garlic, Organic Fenugreek, Niacin, Sulfur, Folic Acid, Riboflavin, Vitamin A Acetate, Organic Dried Feed Grade Milk, Copper Sulfate, Calcium Pantothenate, Organic Lecithin, Organic Egg Product, Pyridoxine Hydrochloride, Organic Cloves, Calcium Sulfate, Organic Barley, Vitamin D3, Acetic Acid, Calcium Hydroxide, Magnesium Sulfate, Vitamin B12, Biotin, Thiamine Mononitrate, Organic Dandelion, Organic Rice Hulls, Ethylenediamine Dihydriodide, Organic Parsley, Organic Althea Root, Organic Dried Tomato Pomace, Yucca Schidigera Extract, Organic Horseradish, Organic Licorice, Organic Sweet Orange Peel, Organic Aloe Vera Gel Concentrate, Organic Peppermint, Organic Calendula, Organic Cayenne Pepper, Organic Ginger, Organic Coconut Oil, Organic Sage, Organic Common Fennel, Organic Thyme, Organic Lemon Grass, Organic Elder Flowers, Organic Papain, Organic Basil, Organic Violet Leaves, Organic Coconut Flour, Organic Juniper Berries.

DIRECTIONS FOR USE:

DAIRY CATTLE:
Top Dress or Add Mix:
1/2 ounce (14.17 g) per head per day.

CALVES:
Top Dress or Add Mix:
1/2 ounce (14.17 g) per head per day.

BEEF CATTLE:
Top Dress or Add Mix:
1/4 ounce (7.09 g) per head per day.
Receiving:
Top Dress or Add Mix:
1/2 ounce (14.17 g) per head per day for 14 days.

SHEEP & GOATS:
Top Dress or Add Mix:
1/8 ounce (3.54 g) per head per day.

SWINE:
Finishing:
Add **3** Pounds Per Ton of Complete Ration.
Grower and Lactation:
Add **5** Pounds Per Ton of Complete Ration.
Starter and Gestation:
Add **7** Pounds Per Ton of Complete Ration.

POULTRY:
Starter:
Add **4** Pounds Per Ton of Complete Ration.
Complete Feed:
Add **2** Pounds Per Ton of Complete Ration.

LLAMAS / EMUS / ALPACAS:
Top Dress or Add Mix:
1/4 ounce (7.09 g) per head per day.

Manufactured for:
Advanced Biological Concepts®
P.O. Box 27 • Osco, Illinois 61274-0027
Phone: 800-373-5971 • **Fax:** 888-770-0735
jgh@a-b-c-plus.com • www.abcplus.biz

Certified Organic by: ECOCERT ICO, LLC.

FPD680-12

A101

Net Weight 25 Pounds (11.36 kg)

Free Choice G.R.P.™

Advanced Biological Concepts® Applied Common Sense.

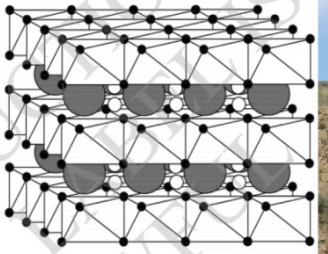
USDA ORGANIC

Dietary Nutritional Supplement for all Classes of Ruminants and Equine

GUARANTEED ANALYSIS

Crude Protein	(min) ----------7.0 %
Crude Fat	(min) ----------2.5 %
Crude Fiber	(max)-------- 10.0 %
Acid Detergent Fiber (ADF)	(max)-------- 10.0 %
Calcium (Ca)	(min) ----------1.0 %
Calcium (Ca)	(max)----------1.5 %
Phosphorus (P)	(min) ----------0.8 %
Sodium (Na)	(min) ----------1.5 %
Sodium (Na)	(max)----------2.0 %
Potassium (K)	(min) ----------1.5 %
Copper (Cu)	(min) ----------1300 PPM
Zinc (Zn)	(min) ---------- 700 PPM
Manganese	(min) ---------- 350 PPM
Vitamin A	(min) ----- 120,000 IU/LB
Vitamin D_3	(min) -------25,000 IU/LB
Vitamin E	(min) ----------400 IU/LB

Glyphosate Matrix



INGREDIENT STATEMENT

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INGREDIENTS:

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Directions: Free Choice

Manufactured for:
Advanced Biological Concepts®
P.O. Box 27 • Osco, Illinois 61274-0027
Phone: 800-373-5971 • **(Fax:** 888-770-0735
jgh@a-b-c-plus.com • www.abcplus.biz

Certified Organic by: ECOCERT ICO, LLC.

FPD549-10

A202

Net Weight 25 Pounds (11.63 kg)

G.R.P.™

Increases utilization of supplemental minerals.

Overcoming glyphosate
chelation toxicity
in animals.

Protecting the quality of our food.

D.U.A.™ and G.R.P.™ technologies are incorporated into both free choice systems.

Advanced Biological Concepts® and **12 Stones Grassland Beef®** free choice systems have been formulated to comply with United States Department of Agriculture National Organic Program and Natural Grass-fed Beef criteria.

Disclaimer:

These products are formulated to meet the requirements of the USDA National Organic Program. Advanced Biological Concepts® and **12 Stones Grassland Beef** accepts no responsibility for performance failure or misuse of this product, or changes of organic and natural protocol that we are not aware of.

Scientists have nutritional knowledge, but animals have nutritional wisdom!
Animals satisfy their nutritional needs based upon environmental conditions,
bio-availability of nutrients, and the absorption capacity of their individual digestive system.

Free choice individual minerals/vitamins provides the only option allowing an animal to meet their individual nutritional needs within their paradigm.

A-Mix (A, D & E Vitamins) Healthy Tissue Growth

Three very important vitamins are A, D, and E. Vitamin A maintains the skin and the linings of the digestive, respiratory & reproductive tracts. Healthy tissues resist invasion by disease. Vitamin A is needed for normal sight and to prevent night blindness. Colostrum is high in Vitamin A.

Vitamin D is the "Sunshine Vitamin." It prevents rickets and is essential for proper bone growth and consistent reproduction. It is linked importantly with calcium:phosphorus utilization.

Vitamin E aids in absorbing and storage of Vitamin A. It is part of the enzyme and hormone systems.

A-Mix (A, D & E Vitamins) 2

FACTORS EFFECTING VITAMIN A CONSUMPTION

1. High nitrates interfere with the thyroid's ability to convert carotene to Vitamin A.
2. Protein deficiency-lowers ability of blood to transport Vitamin A and interferes with liver storage of Vitamin A.
3. High Concentrate Rations - Intensifies Vitamin A requirements.
4. High production (1200 IU Vitamin A necessary for each pound of milk).
5. Low Vitamin A levels within the liver creates high consumption of Vitamin A.
6. Imbalance in Carbon:Hydrogen:Oxygen ratio increases Vitamin A need.
7. Mineral Balance of Rations - All mineral elements are involved either directly or indirectly through enzyme systems, thus Vitamin A utilization.
8. High Temperature - Depresses thyroid activity; thus interferes conversion of carotene to Vitamin A.
9. If Vitamins D or E is deficient or excessive, Vitamin A demands increases.
10. As rumen pH becomes more acid, Vitamin A consumption increases.
11. Stress, weather, mud, rain, cold, heat, dry matter deficiency, disease, parasite load, etc. increase Vitamin A need/consumption.

A-Mix (A, D & E Vitamins) 3

Increased Consumption of A-Mix IS:
1st Indication of Nutritional Management Issue

- **EFFECT OF AN EXCESS OF VITAMIN A**
- **Stored in liver and fat tissue.**
- **Works against Vitamin D.**
- **EFFECT OF A DEFICIENCY OF VITAMIN A**
- **Infection**
- **Nasal discharge, coughing, scouring & watering eyes due to drying and hardening of the mucous membranes, which line the lungs, throat, eyes and intestines.**
- **Severe diarrhea in young calves.**
- **Redness and swelling around dew claws.**
- **Stiffness in the hock and knee joints and swelling in the brisket.**
- **Increased incidence of mastitis and other udder problems due to drying and hardening of the mucous membranes of the udder.**
- **Decline in sexual activity. Sperm decrease in number and mobility.**
- **Loss of appetite.**
- **Zinc deficiency, nitrates and low ash rations increase the need for Vitamin A.**
- **Disease – Calving – Weaning – Internal and/or External parasites.**
- **Limited availability of feedstuffs.**
- **Weather stress, including heat or cold.**
- **Shipping stress**
- **High protein and/or nitrate ration.**
- **High nitrate content of water.**
- **Excess grain or protein of the ration without availability of low protein roughage for dilution.**
- **Vitamin A is chemically an alcohol, therefore a contributor of hydrogen energy.**
- **Low carotene content of feedstuffs.**

BVC-Mix (B Complex Vitamins) Nerves and Stress

B Vitamins are commonly known to be essential for proper digestion, production of HCL and the break down of fats (lipids), proteins (amino acids), fatty acids and carbohydrates. B Vitamins at cellular levels convert glucose into energy. If an animal is consuming BVC we know the digestive system has been compromised and that they have lost ability to produce their own B Vitamins as a by-product of rumen fermentation. The B Vitamins are referred to as the stress vitamins but digging deeper they are a structure of the nervous system including the brain, they support the adrenal glands and the production of hormones. Their need does not just fall within the needs of intra-cellular functions but are essential for RNA and DNA synthesis as well as cell production of skin, hair and hooves. The B Vitamins are a synergistic and tight knit group; deficiency of one will lead to improper function of its constituents. Balance and requirement levels are essential to proper B Vitamin Complex formulations thus meeting the needs of livestock.

I_2-Iodine (I-Mix) Metabolism Regulation

Approximately half of the iodine in the body is located in the thyroid gland, which produce important hormones, such as thyroxin. Thyroxin, which contains 65% iodine, has a regulating effect on body metabolism.

Thyroxin is involved in regulation of basal metabolic rate, temperature regulation, growth & development, neuromuscular function & reproduction.

Iodine absorption is regulated by the body to some extent, but can be toxic. Iodine is well absorbed in any of its soluble forms from all levels of the gastrointestinal tract.

Iodine deficiency causes birth of weak & deformed offspring failing to survive, abortion, infertility, anestrus, reduced conception in all species and other reproductive problems. Severe iodine deficiency results in goiter or lumpy jaw, high incidence of stillbirths, hairless pigs and wool-less lambs at birth.

Phosphorus (P-Mix) Growth and Reproduction

- Phosphorus and calcium together make up 75% of the total amount of minerals in the bodies of farm animals, 90% of the minerals in the skeleton.
- Phosphorus is especially important as more bodily functions are tied to it than to any other nutrient. Besides building strong bones and teeth, it is an important part of many proteins, including the casein in milk.
- Phosphorus regulates enzyme activity and helps maintain vital pressure balance between cells.
- Phosphorus deficiency results in rickets in young animals, osteomalacia in older animals, reduced growth rates, reduced production and silent heats in cattle.
- Vitamin D is involved in kidney re-absorption of phosphorus and phosphorus deposition into bone.
- Excess calcium & magnesium decrease phosphorus absorption. Excess phosphorus may reduce feed intake, may have a slight laxative effect and in ruminants may contribute to urinary calculi.
- Excess phosphorus may result in lameness and spontaneous fractures of long bones.

Phosphorus (P-Mix) 2

- **Calcium:Phosphorus ratio is important - low calcium can depress phosphorus absorption; high phosphorus may result in urinary calculi (water belly in ruminants).**

- **Low calcium and phosphorus appear to cause low vitamin D-3 production. Parathyroid hormone decreases fecal loss of phosphorus which may also be controlled by vitamin D-3.**

- **Phosphorus absorption takes place mainly in the proximal (upper) small intestine. This absorption system can become saturated under certain conditions; 1. Too much dietary phosphorus or 2. When hormonal control of absorption is out of balance.**

Phosphorus (P-Mix) 3

Approximately 70-80% of phosphorus is recycled via saliva. This is particularly important in ruminants. Feed, water consumption and other factors that affect feed intake and reduce saliva flow will reduce absorbed phosphorus. Under these conditions, there will usually be increased urinary phosphorus losses.

Monogastric animals do not efficiently utilize plant phosphorus from grains and oilseed sources. Phosphorus deficiency leads to – anestrus, silent heats in dairy and beef cattle.

If a cow is starved of phosphorus, she is very unlikely to bear a calf.

Phosphorus is the only mineral known to-significantly affect the eating quality of beef.

- **Ca, Mg, Mn, Zn, Fe, Al and Be interfere with the adsorption of P, as well as the opposite being true, due to the formation of insoluble phosphates.**

- **Low Cu – high Mo intakes increase the loss of body P (Cu is required for phospholipid synthesis).**

Phosphorus (P-Mix) 4

The optimum amount is in a range of 0.37-0.41% to the total dry matter. An excess amount of calcium will increase the need for phosphorus. These elements go hand in hand. There is a definite ratio between calcium and phosphorus. When calcium is excessive cattle will eat phosphorus to an excess and then excrete both calcium and phosphorus down to optimum. Phosphorus is acid in nature.

EFFECT OF AN EXCESS OF PHOSPHORUS

- **Excess phosphorus causes and imbalance of zinc, manganese, magnesium, calcium, iron and other elements and symptoms of phosphorus are the same as deficiencies of these other elements because it ties them up as insoluble phosphate salts which are not usable by an animal.**
- **Increases need for iron, aluminum, calcium, magnesium, zinc and manganese.**
- **Poor skeletal growth.**

EFFECT OF A DEFICIENCY OF PHOSPHORUS

- **Increases need for Vitamin D.**
- **Deficiency can be created by excess iron, aluminum, calcium and magnesium.**
- **Depraved appetite-chewing wood, bones, dirt etc.**
- **No heat period, delayed heat period, silent heat period and prolonged interval between calving and first heat period.**
- **Depresses the appetite, reduced rate of gain, milk production falls off.**
- **Un-Digested grain in manure.**
- **Higher incidence of bloat.**
- **Milk fever in dairy herds.**

Calcium (C-Mix) Bone Growth and Vigor

Calcium is necessary, along with phosphorus, for sturdy bones and teeth, and for maximum growth, gain and production. Calcium regulates how well tissue cells absorb nutrients and is vital in the blood clotting process. Calcium is necessary for muscle contraction, normal nerve function, cell permeability (movement of nutrients into cells and waste materials out of the cells), and milk and egg shell production.

Calcium and phosphorus team up together in a ratio of approximately one or two parts calcium to one part phosphorus.

Vitamin D is necessary for proper utilization of these minerals. Vitamin D is involved in the absorption of calcium and deposition of the calcium into bone; excess phosphorus decreases calcium absorption; excess magnesium decreases calcium absorption and excess magnesium can replace calcium in bone and increase calcium excretion from the body. Calcium absorption occurs mainly in the small intestine. Absorption in the digestive tract, re-absorption from the bones and control of urinary losses in the kidney are controlled by the parathyroid hormone (PTH), Vitamin D-3, calcitonin, and to a lesser extent by growth hormone and sex hormones.

Calcium (C-Mix) 2

Parathyroid hormone acts upon bone and kidneys to increase plasma calcium and decrease plasma phosphorus. In turn, low plasma calcium and magnesium result in increased production of PTH. Vitamin D-3 increases bone re-absorption and increases intestinal absorption of calcium and phosphorus by reducing bone re-absorption. Calcitonin and PTH control mechanisms very significant factors during growth, pregnancy and lactation.

Calcium absorption efficiency changes based on body requirements and levels of dietary calcium. This also becomes significant during pregnancy and lactation. Calcium excretion is mainly in the feces. Under normal conditions, very low calcium levels are found in urine.

The optimum amount is in a range of 0.45 – 0.53% of the total dry matter.

Calcium is alkaline.

Calcium ions in the blood regulate production of the calcium regulating hormones. This is called a feedback mechanism for calcium homeostasis.

- **High Ca levels in the diet reduce the absorption of Mn, Zn and Fe.**
- **An excess of either Ca or P interferes with the absorption of the other due to the formation of insoluble tri-calcium phosphate.**
- **Large intakes of either Ca or Mg increases the urinary excretion of the other; but both Ca and P prevent the absorption of excess Mg.**
- **SO4 increases the excretion of Ca.**

Calcium (C-Mix) 3

EFFECT OF AN EXCESS OF CALCIUM

- Decreases availability of protein, phosphorus, iodine, iron, manganese, zinc and magnesium.
- Birth paralysis.
- Depresses rate and economy of gain.
- Increased incidence of milk fever.
- Ties up fatty acids in a form which is not usable.

EFFECT OF A DEFICIENCY OF CALCIUM

- Bone growth severely impaired, resulting in lameness.
- Increases need for Vitamin D2.
- Depraved appetite.
- Arched back.
- No vigor.
- Reduced milk production.
- Calcium deficiency results in rickets in young animals, osteomalacia in older animals, milk fever in dairy cattle, tetany in beef cattle and reduce egg production in birds.
- In ruminants, phosphorus deficiency reduces calcium absorption.

MILK FEVER IN CATTLE

The actual cause of milk fever is a deficiency of phosphorus in the ration during the last 3 weeks of pregnancy. The animal will reduce calcium absorption to maintain a proper Ca:P ratio. When calving occurs there is a sudden demand for more calcium but it takes 72 hours to re-establish calcium metabolism at normal levels. The result is clinical hypocalcemia – low blood calcium or milk fever.

During the last weeks of gestation in dairy cows, the fetus requires about 6 grams of calcium and 2 grams of phosphorus per day. At the onset of lactation, the daily loss (mainly due to milk production) is about 15 grams of calcium and 16 grams of phosphorus. There is a sudden and large demand for calcium and phosphorus ions and, as a result, it is very difficult for the cow to maintain normal calcium and phosphorus homeostasis. The low plasma calcium and phosphorus levels result in muscle weakness and the cows cannot stand.

Intravenous calcium therapy by veterinarians is helpful. Parathyroid hormone, calcitonin, Vitamin D-3 and cation-anion balance may all be involved. This is not a simple, straight forward problem that is easily controlled or cured.

Downer sows are experiencing the same homeostatic control problems.

Magnesium (M-Mix)

Bone and Blood Development

Magnesium is an enzyme activator primarily involved in energy metabolism and bone formation

Magnesium improves calcium and phosphorus metabolism and calcification of bone. Magnesium is needed by the body in relatively small amounts but is very important to life. About 70% of the magnesium in the body is in the bone, combined with calcium and phosphorus. Muscle contains more magnesium than calcium. Magnesium is present in the blood, organs and tissue fluids of the body. A deficiency of magnesium in the blood causes grass tetany in cattle, a highly fatal disease.

Magnesium absorption takes place mainly in the small intestine and to a lesser extent through the rumen wall. However, due to the very large surface area of the rumen wall, the rumen makes a substantial contribution to total magnesium absorption. Plasma magnesium may be the major factor controlling absorption. There appears to be poor regulation mechanisms in the body to control magnesium losses. Magnesium is excreted in the urine and feces.

Magnesium (M-Mix) 2

Magnesium deficiency results in vasodilation (blood vessels relax and increase in size), extreme irritability with convulsions, loss of equilibrium and trembling and tetany (as seen in cattle in the spring with grass tetany). High calcium and high phosphorus depress magnesium absorption. With high dietary phosphorus, there may be formation of insoluble magnesium-phosphate salts that are excreted in the feces. When these insoluble salts form in the kidneys, urinary calculi results.

MAGNESIUM – The optimum amount is in a range of 0.29 – 0.3% of the total dry matter.

Magnesium is alkaline.

Magnesium toxicity is unlikely under most conditions. Large doses of magnesium have a laxative effect.

Magnesium (M-Mix) 3

EFFECT OF AN EXCESS OF MAGNESIUM

- Increases need for phosphorus and other elements.

EFFECT OF A DEFICIENCY OF MAGNESIUM

- Irritability
- Irregular gait or shifting lameness.
- Weak pasterns.
- Muscle tremors.
- Grass Tetany - animals may be temporarily blinded; may turn in circles until balance is completely lost: frothing at the mouth.

GRASS TETANY

Magnesium deficiency-induced grass tetany occurs mainly in the spring (occasionally in the fall) when fast growing pasture grasses are the primary forage for cows. It is also seen more frequently on fertilized pastures (especially when fertilized with commercial N-P-K based fertilizers). High potassium depresses magnesium absorption. The sodium/potassium ratio appears to be more important than the potassium concentration.

Magnesium forms a chemical complex with ammonia in the rumen. High ammonia levels are normally seen with the very high soluble protein levels normally found in growing grasses. The ammonia can be used by rumen bacteria to make amino acids/ proteins provided there is adequate carbohydrate (energy) sources available to the bacteria.

Fast growing grasses have a very high water content and are relatively low in energy. The tetany seen with magnesium deficiency may be brought on by emotional stress (such as moving cattle, attempting to rope or corral the animal for treatment), and/or by cold temperature stress.

K-Mix (Potassium)

Proper Growth & Nerve Response

Potassium is required by the animal body for normal nutrition and is linked with calcium and phosphorus in bone building processes. Its presence affects feed efficiency by aiding rumen bacterial growth and proper cell pressure for nutrient utilization. Muscle and nerves need potassium for proper maintenance.

The optimum amount is in a range of 0.93 – 1.02% of total dry matter. Potassium is a strong base. If excessive, the rumen requires more chlorine to excrete the excess as potassium chloride.

Potassium is one of the major cations involved in osmotic pressure balance, acid-base balance, normal muscle contraction, activity and plays a major role in carbohydrate metabolism.

Forages normally contain more than adequate potassium for ruminants, but high grain rations may require potassium supplementation.

Potassium needs to be supplied daily because there is no appreciable reserve.

Deficiency symptoms of either Sodium or Potassium are aggravated by an excess of the other.

K-Mix (Potassium) 2

EFFECTS OF AN EXCESS OF POTASSIUM

- Excess potassium is excreted quickly in the urine but this may cause a wash out situation which can disturb the calcium:phosphorus balance.
- Excess potassium reduces magnesium absorption.
- Magnesium deficiency reduces potassium retention leading to potassium deficiency.
- Alkaline rumen, unless chlorine is also present.
- Slows down bacterial growth and multiplication.
- Poor feed efficiency.
- Pressure inside the cell is too great for movement of food into the cell.

EFFECTS OF A DEFICIENCY OF POTASSIUM

- Decreased carbohydrate utilization.
- Slow growth.
- Reduced appetite.
- Muscular weakness.
- Nervous disorders.
- Potassium deficiency results in diarrhea, distended abdomen, untidy appearance, unsteady gait and abnormal electrical activity in the heart. If severe, lethargic conditions with high incidence of coma and death.

S-MIX (Sulfur)

Protein Formation

- Sulfur is necessary for the life of animals, for it is an essential part of most proteins. Sulfur is necessary for the synthesis of sulfur bearing amino acids.
- A deficiency limits non-protein nitrogen utilization.
- Sulfur aids in production of healthy hair coats plus hoof and horn development.
- Sulfur is a component of methionine and cystine (sulfur amino acids), a component of biotin and thiamine, and is involved in tissue respiration and energy metabolism through the sulfhydryl chemical groups. SULFUR – The optimum amount is in a range of 0.20 - 0.22% of the total dry matter. Sulfur is acid in nature. Sulfur – nitrogen ration should be 1 – 10.
- Sulfur supplementation may be necessary for ruminants when urea is being fed as a source of non-protein nitrogen.
- Sulfate – S limits Cu and Ca storage and protects against the toxicity.
- High Zn increases fecal S.
- SO4 decreases liver Mo.

S-MIX (Sulfur) 2

EFFECT OF AN EXCESS OF SULFUR

- Creates an acid rumen.
- Increases need for copper.
- A laxative effect – black scours.
- Sulfur toxicity is unlikely under normal conditions.

EFFECTS OF A DEFICIENCY OF SULFUR

- Limits NPN (non protein nitrogen) utilization.
- Reduced growth rate due to sulfur amino acid requirements for protein synthesis not being met for the animal.
- Poor hair coat – shedding wool in sheep.
- Poor hoof, hair and horn development.
- Excess saliva.
- Watery eyes.

Zn-Mix (Zinc)

- Zinc is a cofactor in as many as 340 enzyme systems in the body, including many digestive enzymes (involved with every protein synthesis reaction in the body). Zinc helps to increase gains through feed efficiency.
- It is necessary for bone and feather development.
- Zinc is necessary for proper utilization of copper and iron. High calcium reduces zinc absorption.
- Phytic acid in plants binds zinc. Zinc absorption takes place in the small intestine and in the abomasum of cattle. The initial uptake into intestinal cells involves amino acid ligands and other chelating/complexing agents.
- Once in the intestinal cell, zinc is bound to metallothionein. Metallothionein is the main storage form in all cells of the body. Many ligands have been shown to enhance zinc absorption, among these are citrate, EDTA, certain amino acids, and certain vitamin metabolites. Other dietary components such as phytate, calcium, phosphorus, copper, cadmium, certain fiber fractions and Vitamin D influence zinc absorption.
- Zinc uptake is more efficient in young animals, during pregnancy and lactation (hormonal influence or increased body requirements). Absorption efficiency seems to depend on the body's needs, so there is some degree of homeostatic control of both uptake and excretion. Zinc uptake is influenced by chemical form, solubility, particle size, rate of reactivity and pH of the diet and at the site of absorption.

Zn-Mix (Zinc) 2

EFFECTS OF AN EXCESS OF ZINC

- **Interferes with utilization of copper and iron and may actually induce copper deficient anemia.**

EFFECTS OF A DEFICIENCY OF ZINC

- **Poor reproduction, reduced conception and reduced immune response in all species.**
- **Poor feed efficiency and poor growth.**
- **Lesions of the skin, poor hair and feather development; rough and thickened skin (parakeratosis), bald spots.**
- **Legs tender, easily injured, raw, bleeding and weak.**
- **There is also a decreased ability to make antibodies and resist diseases due to depressed protein synthesis.**

Cu-Mix (Copper) Blood & Hair Coat

- Copper is involved in many oxidation-reduction reactions within the body, bone formation, maintenance of nerve tissue, normal heart function, normal hair pigmentation and reproduction. Copper (along with iron) is involved in hemoglobin synthesis.
- Absorption of copper is mainly from the upper small intestine by binding to intestinal proteins or peptide molecules. Absorption can be disrupted by nutritional imbalances such as acidosis, intestinal bacterial infections, parasitic infestations or feed toxins.
- Copper absorption may be regulated by body needs. Absorption efficiency is greater in deficient animals. during pregnancy (hormonal influence?). Young animals absorb copper more efficiently than older animals (as much as three times greater efficiency).
- Copper availability in forages ranges from 6% to 34%. Factors that are known to affect copper uptake include chemical form of copper in the diet. At site of absorption Copper in forages are bound to low molecular weight complexes that do not appear to remain intact in the gastrointestinal tract. Molybdenum and sulfur reduce the availability of copper.

Cu-Mix (Copper)

Cu is required for the proper metabolism of Fe.

Cd and Ag increase the severity of Cu deficiency.

High dietary Zn reduces liver stores of Fe and Cu while low Zn favors excess storage or Zn.

Excess Cu causes low storage of Zn.

Mo limits Cu storage in the presence of adequate sulfate. Sheep with high liver Cu have low Mo levels and Cu toxicity may develop with low Mo intakes.

Cu-Mix (Copper)

EFFECTS OF AN EXCESS OF COPPER

- Degeneration of liver, distended gall bladder and swollen, black kidneys, blood in urine.
- Poor utilization of nitrogen.
- Yellowish brown mucous membranes about the eye and mouth.

EFFECTS OF AN DEFICIENCY OF COPPER

- Created by an excess of molybdenum and cobalt.
- Anemia due to poor iron utilization.
- Depressed appetite and growth.
- De-pigmentation of hair and abnormal hair growth, stringy wool or lack or wool in young lambs.
- Decreased ability to make antibodies, a delayed immune response, increased susceptibility to diseases
- Impaired reproductive performance, anestrus, abortion, retained placenta and difficulty in calving and calves born weak or dead.
- Depraved appetite.
- Scouring.
- Fragile bones, lameness and swelling of joints.
- Muscular in-coordination and nervousness.

BUFFER PLUS

The Buffer Plus is very successful in counteracting low rumen pH and increases utilization of protein. The combination of sodium, magnesium, potassium and calcium make this a very valuable additive to the ration. A dose of enzyme is added to facilitate bacterial growth in the rumen. One ounce per head per day of Buffer Plus will provide the same buffering as 4-6 ounces of sodium bicarbonate, plus it will produce a remarkable increase in the rumen 'bug' crop.

TS K-Mix

Trace Minerals plus Selenium

- The need for trace element supplementation has increased in recent years due to the gradual depletion of minerals in farm soils and increase animal confinement. Trace elements iron, manganese, cobalt, zinc and manganese are minor but essential minerals in livestock nutrition.
- Selenium – Vitamin E metabolism.
- Iron (along with Copper) is essential to form hemoglobin in the blood.
- Manganese affects the metabolism of calcium and carbohydrates.
- Cobalt is needed to enable rumen bacteria to synthesize Vitamin B12. Cobalt deficiency causes loss of appetite, weakness, anemia, decrease is fertility and lowered milk production.
- Prolonged stress or disease can create a new set of metabolic and nutritional requirements for nutrients. If the animal cannot maintain adequate plasma and tissue levels, as well as adequate enzyme activity levels, the disease become more difficult to control. Loss of these nutrients can result in depressed or reduced immune response.

Se (Selenium)

- Selenium is involved in Vitamin E absorption, utilization and retention. It is essential for glutathione peroxidase activity, which helps in prevention and repair of oxidation (rancidity) of lipid material.
- Selenium is found primarily in muscle and high protein tissue, with very little selenium found in fatty tissue. Blood selenium levels are highly responsive to changes in dietary selenium levels.
- Excretion of selenium is primarily in the urine. Urinary losses appear to be dependent on a renal threshold, that is, selenium is conserved by the kidneys up to a certain level, and there is essentially 100% loss of selenium over that level.
- Selenium deficiency results in muscular dystrophy (white muscle disease) in calves and lambs, exudative diathesis in poultry, liver necrosis in pigs and retained placentas in beef, dairy, sheep and swine.
- Selenium toxicity results in blind staggers or alkali disease which is characterized by hair loss, sloughing of hooves, lameness, excessive salivation, blindness, paralysis and death. In poultry, egg production and hatchability are reduced and there is a high incidence of deformities, including lack of eyes and deformed wings and feet.
- High sulfate and As levels as well as high protein in the ration protects against selenium toxicity.

SE Top Choice Mix

Speak with your Advanced Biological Concepts representative about applications for SE Top Choice Mix.

MOP

Mop a blend of bentonites: A source of silicon found in the tissues of all mammals. MOP is designed for multiple nutritional purposes however as an absorbent is beneficial to reduce imbalanced nutrients and for detoxification. Benefits of its expansion like a sponge, once introduced to digesta fluid, creates a disposal system for the body. Excess mineral elements ingested from imbalanced feedstuffs and supplements are absorbed and carried away reducing elemental imbalances. This bentonite sponge will also assist with reducing liver stress. The liver is often stressed removing toxins introduced into the blood stream. If MOP is able to bind toxins beginning in the digestive system then the elimination organs will be able work efficiently without creating further health concerns. In today's world, MOP is a multi-purpose product to battle an animal's exposure to aflatoxins, molds, funguses, de-wormers, antibiotics and poor-quality and imbalanced grains, roughages and water.

KLNZ Mix

KLNZ a proprietary blend specifically designed to assist with specific environmental toxins, while maintaining digestive pH levels.

KLNZ is designed to be used with an Advanced Biological Concepts' representative support.

N.O.M.S. / IPR Pellets

- **N.O.M.S./IPR is developed using a blend of Chinese herbs that have been used for over 2000 years to control parasites.**
- **A blend of bentonites, proven to condition the digestive tract, creating an environment that is not accommodating to parasites/worms.**
- **Diatomaceous Earth is added to our mix as a carrier. The benefits of DE are backed by a two-year research study. Documented and published by the MN Department of Agriculture.***

***See Diatomaceous Earth study. Next page.**

Project Title: **Evaluating Diatomaceous Earth as a Wormer for Sheep and Cattle**

Time Span: April 92 to December 94

Principal Investigator: David Deutschlander
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Pine City, MN 55063

Tel: 612-629-2744
County: Pine

Enterprise: Sheep, Dairy

Project Description

Controlling parasitic worms in a livestock operation is critical in maintaining a productive and healthy flock of sheep or herd of cows. Medicating the animals to control parasitic worms in many cases is time-consuming, labor-intensive, and expensive.

Diatomaceous earth (D.E.), fossilized deposits of diatoms (tiny phytoplankton found in oceans and lakes), has been used for centuries to control insect pests and parasites. The silica shell of the diatoms kill insects and worms upon contact by dessicating and absorbing the waxy or oily cuticle layer of the bugs. D.E. is advantageous compared to synthetic insecticides or de-worming medication because it is natural, effective, non-toxic, and affordable.

Many producers are not aware of this resource so this project will:

1. Demonstrate and evaluate the use of D.E. as a wormer when fed free choice as a mineral mix to ewes on pasture.

2. Evaluate D.E. as a wormer for dairy youngstock on pasture when fed in a mineral mix.

3. Record observations of the fly control and external parasite control potential of D.E. in livestock production.

1992 Project Results

Both lambs and heifers were given D.E. free choice. The lambs were observed to eat D.E. and go back for more.

Before this study began, the ewes tested *medium* level of (Haemonchus) barber-pole worms. D.E. was fed to the ewes at a rate of 50% D.E. and 50% mineral supplement. Twelve weeks after D.E. treatment, the ewes tested *medium low* Haemonchus although no other worming medication was used.

Lambs fed with D.E. appeared to have a faster weight gain, cleaner tails, and brighter wool. The overall body condition of the lambs seemed to improve.

D.E. fed free choice to 500 pound heifers on pasture showed no worms either mid- or late-season. The cattle consumed D.E. at a rate of 1 lb per week per heifer.

There appeared to be less problem with gnats on the faces and backs of the animals sprinkled with D.E.

D.E. may also have contributed to reducing the number of flies on the farm.

Cost Comparison of Diatomaceous Earth to Conventional Worming Medication

Conventional Medication*	$1.50/head/year
Diatomaceous Earth	$0.20/head/year

*administered 3 times/year - very labor intensive.

1993 Project Results

Lambs that were born between April 15 and May 10 were raised on pasture, with no grain, and fed a free-choice mixture of one-third D.E. and two-thirds salt. No other worming program was used. On October 20th, 72% of the lambs were sold as finished lambs and averaged 120 pounds each. The other 18% were sold as feeder lambs and averaged 104 pounds.

After weaning, the ewes were judged to have a body condition score of about 2.8. They only fed on pasture forage and had the same worming program as the lambs of 1/3 D.E. and 2/3 salt.

The dairy cows and heifers were offered D.E. free-choice all year. Fecal samples from the dairy heifers showed no signs of worms.

Cost Comparison of Diatomaceous Earth to Conventional Worming Medication

Conventional Medication*	$1.80/head/year
Diatomaceous Earth	$0.28/head/year

*administered 3 times/year – very labor intensive.

OBSERVATIONS: Gnats and flies were less of a problem this year. This could be as a result of the D.E. or the cool summer or a combination of both. When the dairy cows were without D.E. for a few days they would crave D.E. and eat several pounds when it was given to them. This heavy feeding of D.E. did not have any side effects on the cows and they remained in good condition.

Management Tips: 1. Free Choice feeding of D.E. is the best option. 2. A dust bag with D.E. helps a lot for fly control.

Energy and Sustainable Agriculture Program * Minnesota Department of Agriculture

Fe (IRON)

- Iron is involved in carrying oxygen, oxygen transfer in hemoglobin in the blood and myoglobin in muscle cells.
- Milk is low in iron and large changes in dietary iron levels will have little or no effect on milk iron levels.
- Folic acid is involved in iron metabolism. Pyridoxine deficiency decreases iron absorption.
- Ascorbic acid and certain amino acids may enhance iron absorption.
- Calcium and phosphorus influence iron absorption.
- Copper is required for proper iron metabolism. Copper, zinc, manganese, cobalt and cadmium may all compete for the same binding sites.
- Phytic acid and phosphorus can form insoluble chemical complexes with iron.
- Excess iron may create a phosphorus deficiency. High urea levels to cattle and high copper levels to pigs and poultry may induce iron deficiency.
- Blood loss and parasitic infestations may induce an iron deficiency.
- Iron deficiency is rare in grazing cattle.

Fe (IRON) 2

Iron deficiency results in anemia, low hemoglobin, low red blood cell counts and loss of appetite.

Iron deficiency anemia frequently seen in very fast growing young animals (especially pigs).

Too much iron may make bacterial infections worse (especially intestinal bacterial infections) as many pathogenic bacteria have a high requirement for iron.

Iron deficiency in dams, and their off-spring, increase susceptibility to bacterial infections and parasitic infestations. The off-spring will frequently have diarrhea due to increased susceptibility and depressed ability to make antibodies - this is a long term effect which is not overcome by iron supplementation.

Ca and especially Al salts protect against Fe toxicity.

Iron oxide is poorly available for animal absorption and is used primarily as a coloring agent in mineral mixes.

MANGANESE

Manganese is a co-factor in enzymes involved in carbohydrate metabolism, amino acid metabolism, fatty acid synthesis and cholesterol metabolism. Manganese is involved in normal growth, normal bone formation and normal reproduction.

The efficiency of manganese absorption decreases as dietary levels increase. Calcium, phosphorus, copper, zinc, iron and phytate reduce manganese absorption. Manganese is the only mineral with significant absorption in the large intestine. The absorption rate for manganese is low and relatively constant at 1 – 4 %. There is tissue storage of manganese in bone, muscle, liver, gastro- intestinal tract and pancreas.

There appears to be homeostatic control of manganese absorption and excretion, but the control mechanisms are unknown.

Manganese deficiency results in poor growth, impaired reproduction (testicular degeneration in males, defective ovulation in females), and slipped tendon in birds. Manganese deficiency is involved in anestrus in all species.

High Mn interferes with Iron utilization and lowers serum Mg.

COBALT

- **Cobalt is a component of Vitamin B-12 and is added to feed products to provide the cobalt needed by bacteria to synthesize Vitamin B-12. There appears to be little need to add cobalt to the diets of non-ruminants.**
- **Cobalt deficiency results in anemia that is different from iron and copper deficiency anemia. Other symptoms are reduced appetite and reduced growth rates.**
- **Cobalt increases the urinary excretion of Iodine.**
- **Fe accumulates during Co deficiency (Co needed for Fe metabolism.**
- **Cobalt toxicity is unlikely due to the very high cost.**
- **Cobalt Deficiency has been linked to increased incidence of Brucellosis.**

NaCl (Salt) (Sodium Chloride)

Sodium is one of the major cations involved in acid-base balance, osmotic pressure balance, normal cell irritability and nerve function, cell permeability and water balance.

Sodium aids in maintaining correct pressure in body cells, upon which depends upon the transfer of nutrients to the cells and removal of waste materials. Blood is richer in sodium than in other minerals. Many body functions produce strong acids. Some alkaline chemical is needed to "balance" all the acidity in the body. Sodium aids that function. Sodium helps to control muscle tension in the heart. It helps in production of liver bile, a digestive aid, and it aids in hair coat formation. Deficiency symptoms of either Sodium or Potassium are aggravated by an excess of the other. The optimum amount is in a range of 0.27 – 0.3% of the total dry matter. Sodium is strongly alkaline. 90% of all rations are usually short of this element.

NaCl (Salt) (Sodium Chloride)

CHLORINE

Chlorine is the major anion involved in osmotic pressure balance, acid-base balance, and hydrochloric acid production for digestion in the stomach.

Chlorine deficiency results in reduced growth rates. If the deficiency is severe, it may result in hypochloremic alkalosis (a blood pH imbalance) due to vomiting (in those species that can vomit).

Chlorine toxicity is unlikely under normal conditions due to rapid clearance through the kidneys.

NaCl (Salt) (Sodium Chloride)

EFFECT OF AN EXCESS OF SODIUM

- Sodium may be toxic if over 8% in the diet.
- Sodium toxicity symptoms are staggering gait, blindness, nervous disorders and hypertension. Clean fresh water is the treatment for salt toxicity.
- Swelling due to excess water retention.
- Creates alkaline rumen – may be excessive.
- Slows down bacterial growth.
- Poor utilization of non protein nitrogen.

EFFECT OF A DEFICIENCY OF SODIUM

- A severe sodium deficiency may result in eye problems. Drinking of urine may be an indication of sodium deficiency.
- Cannibalism and reduced egg production in poultry.
- Decreased utilization of protein and energy.
- Rough hair coat.
- Retarded growth rates, reduced feed efficiency, reduced milk production and weight loss.
- Depraved appetite or loss of appetite.
- Poor reproduction - infertility in males and delayed sexual maturity in females.
- Acidosis.

Additional Mineral Interrelationships

BORON

EFFECT OF AN EXCESS OF BORON.

- Diarrhea.
- Increased flow of urine.
- Visual disturbances.

B. EFFECT OF A DEFICIENCY OF BORON.

- Reduces rate of growth and rumen bacteria.

CHROMIUM

EFFECT OF AN EXCESS OF CHROMIUM.

- Growth depression.
- Liver and kidney damage.

EFFECT OF DEFICIENCY OF CHROMIUM

- Level of chromium is closely associated with glucose metabolism.
- Impaired growth.
- Opacity of cornea of eye.
- Corneal lesion.

MOLYBDENUM

EFFECT OF AN EXCESS OF MOLYBDENUM.

- Makes copper unavailable.
- Depigmentation of hair.
- Severe scouring.
- Dehydration.
- Arching of back.
- Weakness.
- Brittle bones.

EFFECT OF A DEFICIENCY OF MOLYBDENUM.

- Created by excess of sulfur. ‘
- Slows down cellulose digestion.
- Calcium deposits in kidneys.
- Chronic copper poisoning-depending on level of copper.
- Slows down the conversion of nitrogen to protein.

NICKEL

EFFECT OF AN EXCESS OF NICKEL.

- Ration unpalatable.
- Excess nickel reduced by chelated iron.

FLUORINE

EFFECT OF AN EXCESS OF FLUORINE.

- Dental abnormalities such as mottled enamel, size, shape, etc.
- Severe reduction in feed intake, reduced production.
- Stiffness in legs, enlarged joints, enlarged bones.
- Rapid decline in health death.

EFFECT OF A DEFICIENCY OF FLUORINE.

- Tooth decay.
- Poor microbial growth.

ALUMINUM

EFFECT OF AN EXCESS OF ALUMINUM.

- Increased need for phosphorus.

EFFECT OF A DEFICIENCY OF ALUMINUM-

- Because of its prevalence, a deficiency of aluminum is not usually a practical problem. Under controlled clinical conditions it has been tied with conversion of energy.
- Leg deformities with over-knuckling in calves.
- Egg not formed correctly. Degeneration of testicles. Sterility.
- Offspring born dead.
- Delayed heat periods.
- Shortage created by excess of calcium and phosphorus.

NITRATES

When nitrates are present in feed or water, the following precautions should be taken regardless of the results of the feed test:

- **Check to see that phosphorus, iodine and Vitamin A are available since nitrates increase the need for these substances.**
- **Increase the energy value of the ration since extra energy is required to convert nitrates to ammonia.**
- **Feed free choice low protein roughage in liberal amounts, (corncobs, grass, hay and corn stalks) to reduce the nitrogen content of the ration.**
- **Dilute or discontinue feed and/or water high in nitrates.**

Level of Nitrates in Feedstuffs and Expected Animal Response

Level of NO3 ion in Feedstuffs on a Dry Matter Basis PPM's	Animal Response
0-3000 0-0.3	Normal if on adequate ration
3000-6000 0.3-0.6	Milk production drops. Slow at first increasing after6 to 8 weeks. Typical Vitamin A deficiency symptoms in the 6th to 8th week.
6000-9000 0.6-0.9	Milk production loss in 4 to 5 days. Reproduction could become very difficult and if conditions continue over a long period of time abortion is possible.
9000-over 0.9-over	Death, usually several head and suddenly.

Level of Nitrates in Water and Expected Animal Response

Level as in NO3 ion in water PPM's	Animal Response
0-44 0-0.0044	Normal
45-132 0.0045-0.0132	Normal if no nitrates in feed.
133-220 0.0133-0.0220	Milk production drops, slow at first.
220-660 0.0220-0.0660	Rapid milk production loss, abortion, at high levels some death.


Thank you for your attention.
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